Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Impact of resolution increase for seasonal forecast quality in EC-Earth

Chloé Prodhomme, F. Massonnet, L. Batté,
V. Guemas, P. Davini, F. Doblas-Reyes

SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

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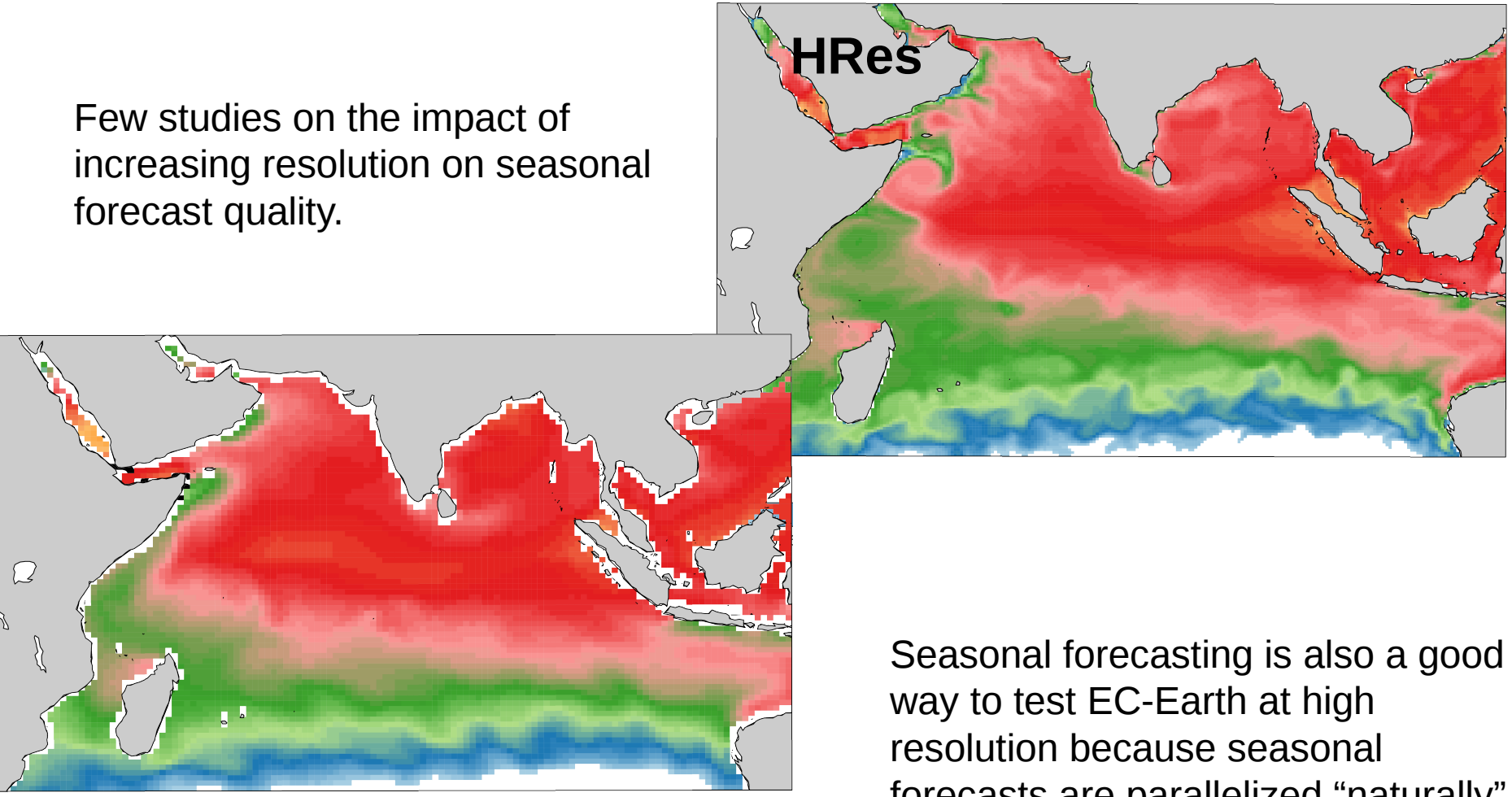
Introduction

Past studies have shown that an increased resolution improves different aspects of the simulation from small scale to global and from intra-daily to decadal.

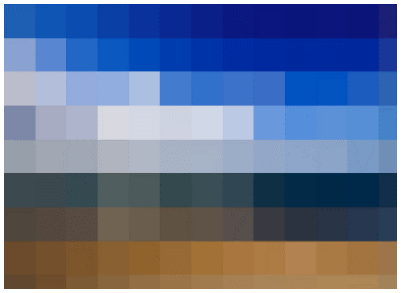
Few studies on the impact of increasing resolution on seasonal forecast quality.



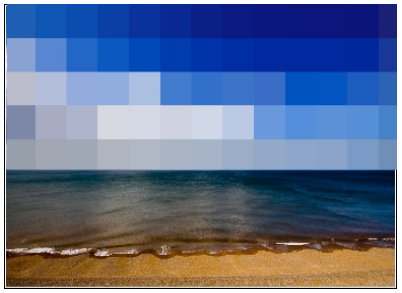
Seasonal forecasting is also a good way to test EC-Earth at high resolution because seasonal forecasts are parallelized “naturally”.

Experimental design

SRes (T255/ORCA1)
1º - 70km



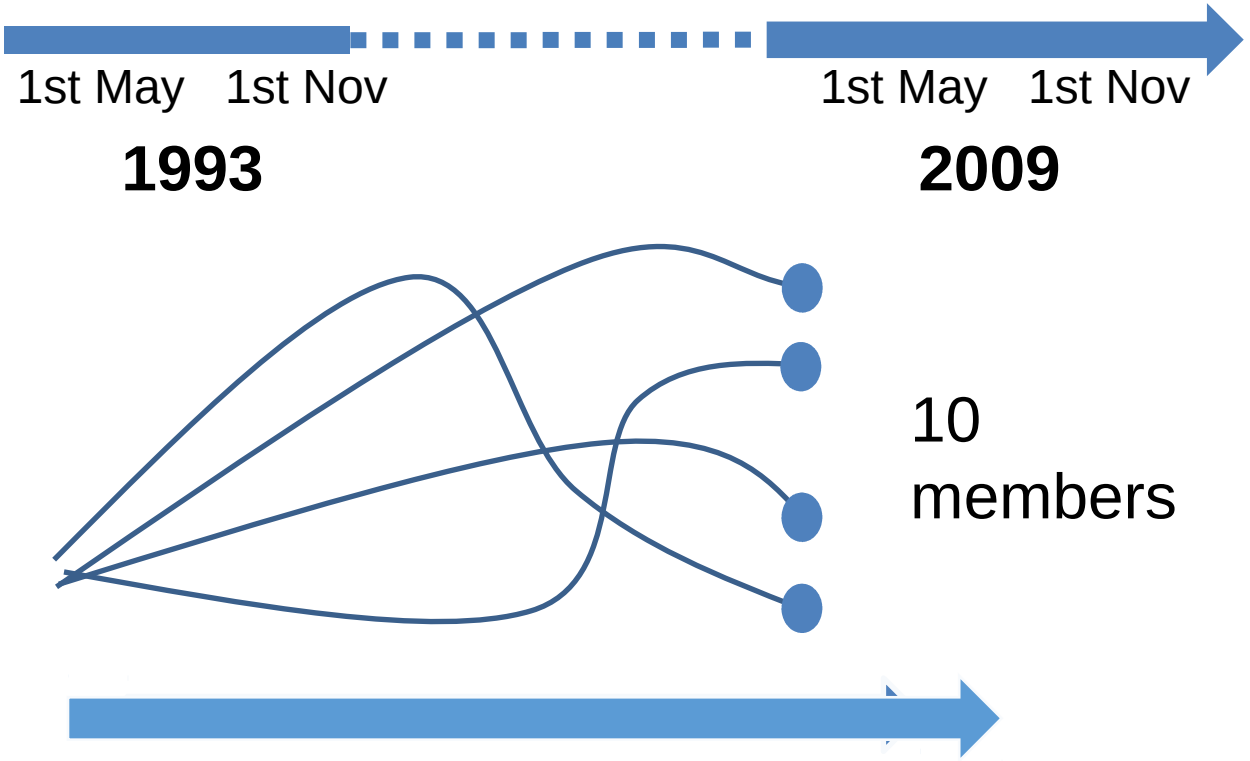
IRes (T255/ORCA025)
0.25º - 70km



HRes (T511/ORCA025)
0.25º - 40km

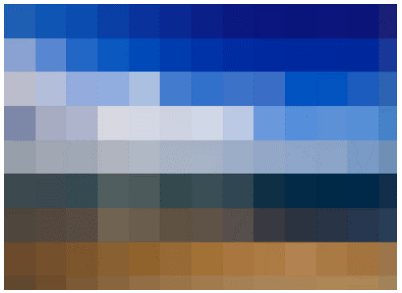
Seasonal retrospective hindcasts performed with **EC-Earth 3.0.1**

34 start dates: May and November every year between 1993 and 2009



Numbers and reminder for fair comparison

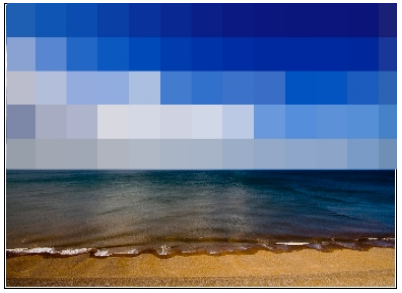
SRes (T255/ORCA1)
1º - 70km



CPU/month/member: 75

x 6

IRes (T255/ORCA025)
0.25º - 70km



CPU/month/member: 493

x 4

HRes (T511/ORCA025)
0.25º - 40km

CPU/month/member: 2256

- The initialization product (GLORYS) is performed at high resolution so the IC have been interpolated.

- SRes had more tuning than IRes and HRes.

- Less tuning had been performed at these resolutions

- Only vertical interpolation for the IC.
- Eddy permitting
- Better coupling (thinner ML)
- Bathymetry

- Better orography…

Impact on the mean climate

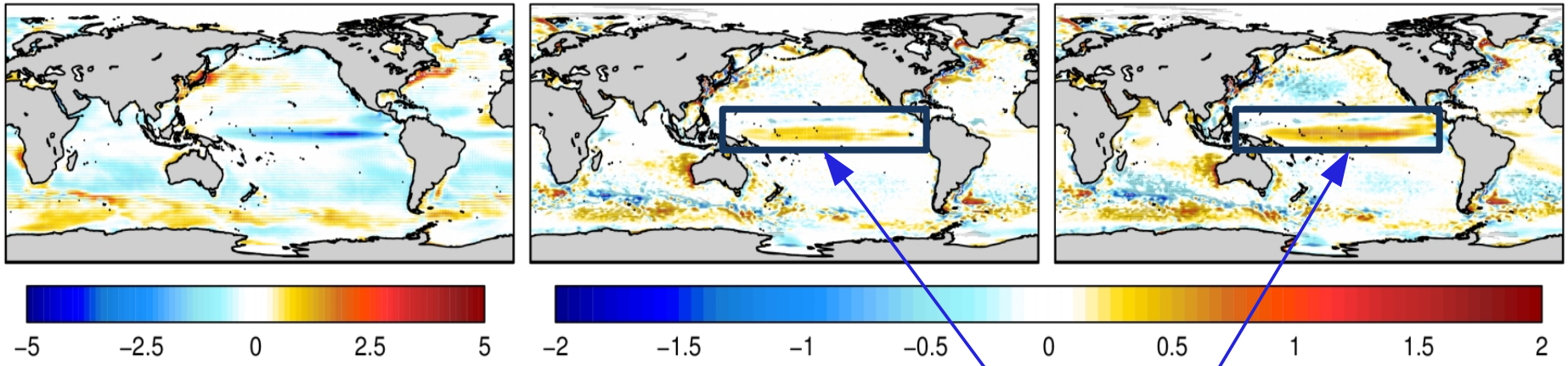
November start dates:
DJF (1 month forecast time)

SST

SRes - ERSST

IRes - SRes

HRes - SRes



Improvement of the cold tongue bias
(stronger in HRes)

Impact on the mean climate

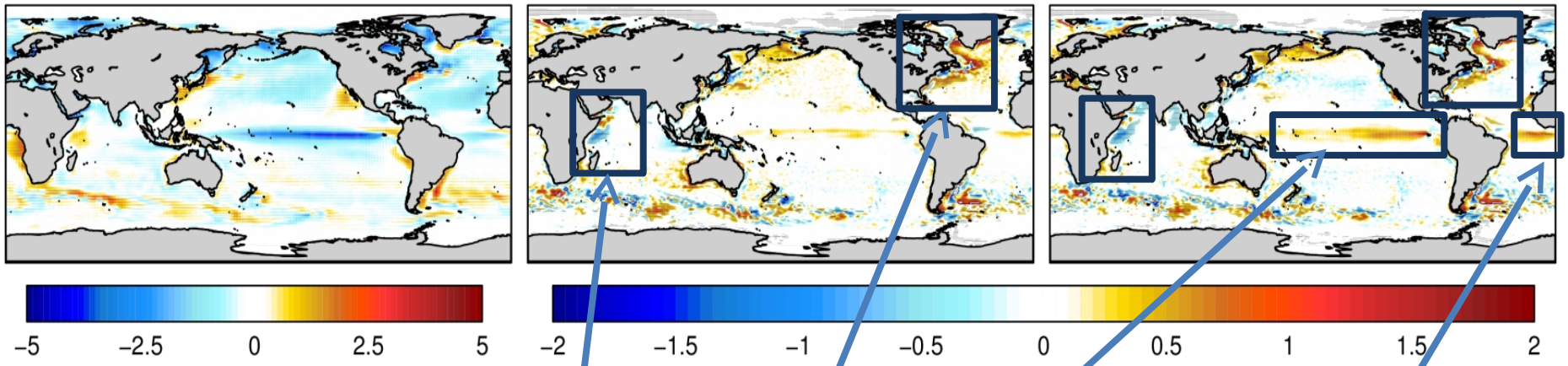
May start dates:
JJA (1 month forecast time)

SST

SRes - ERSST

IRes - SRes

HRes - SRes



Improvement of the Somalian Upwelling

Improvement of the cold tongue bias.

Improvement in the equatorial Atlantic

Reduction of the cold bias in the Northern Hemisphere

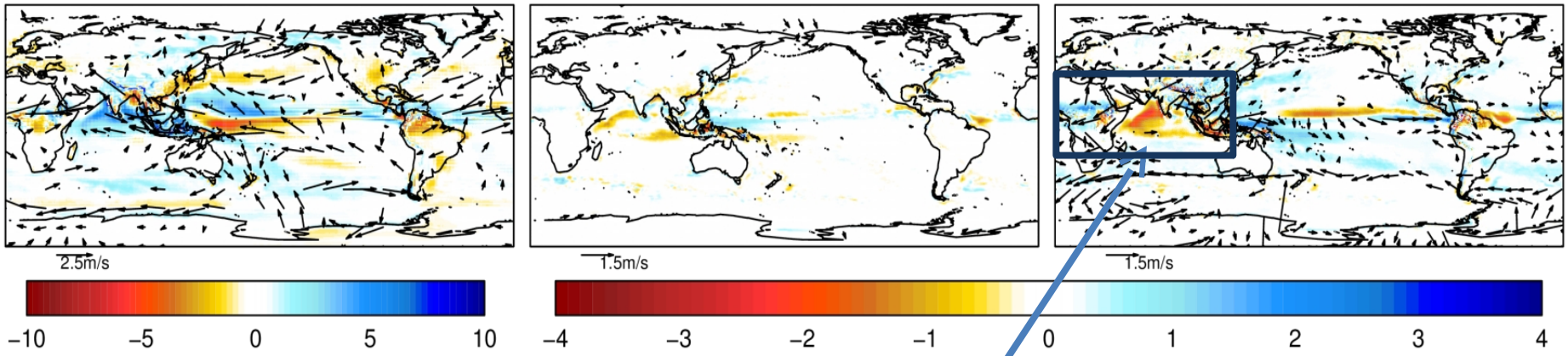
Impact on the mean climate

May start dates:

JJA (1 month forecast time)

Precipitation – wind at 850hPa

SRes - ERSST | IRes - SRes | HRes - SRes

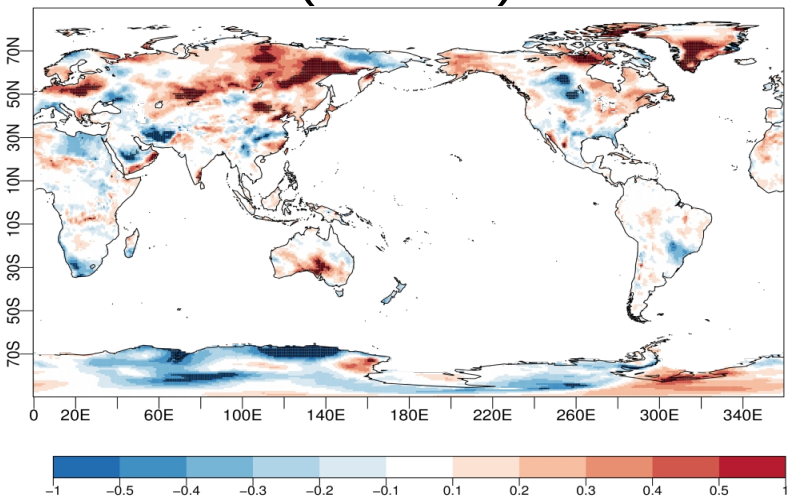


Change in the African and Indian monsoon:
- reduction of excessive oceanic precipitation in the Indian Ocean
- no improvement for land precipitation

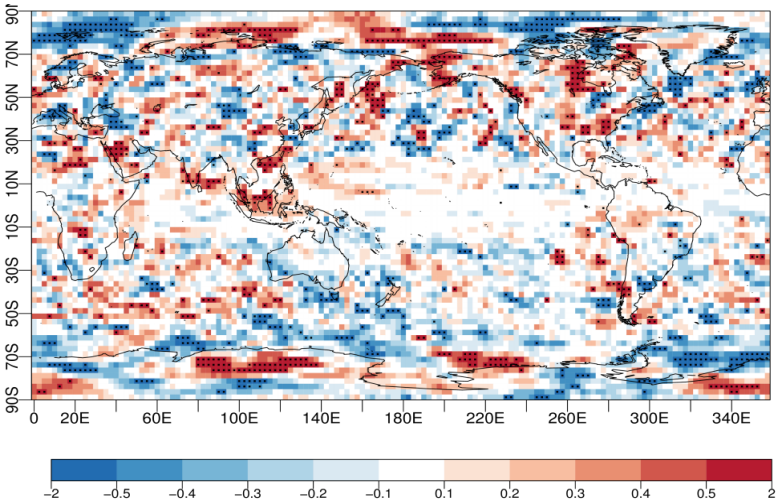
Impact on skill: Correlation HRes-SRes

Forecast initialized in May (1 month forecast time)

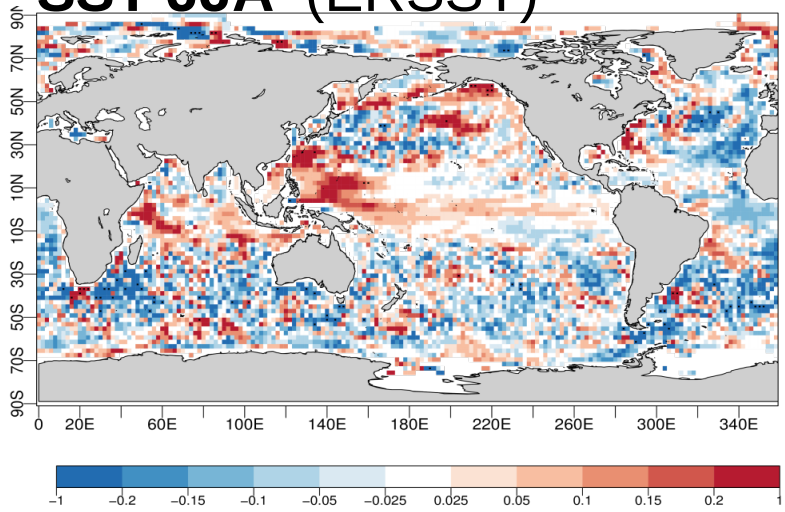
T2m JJA (ERAint)



Precip JJA (GPCP)

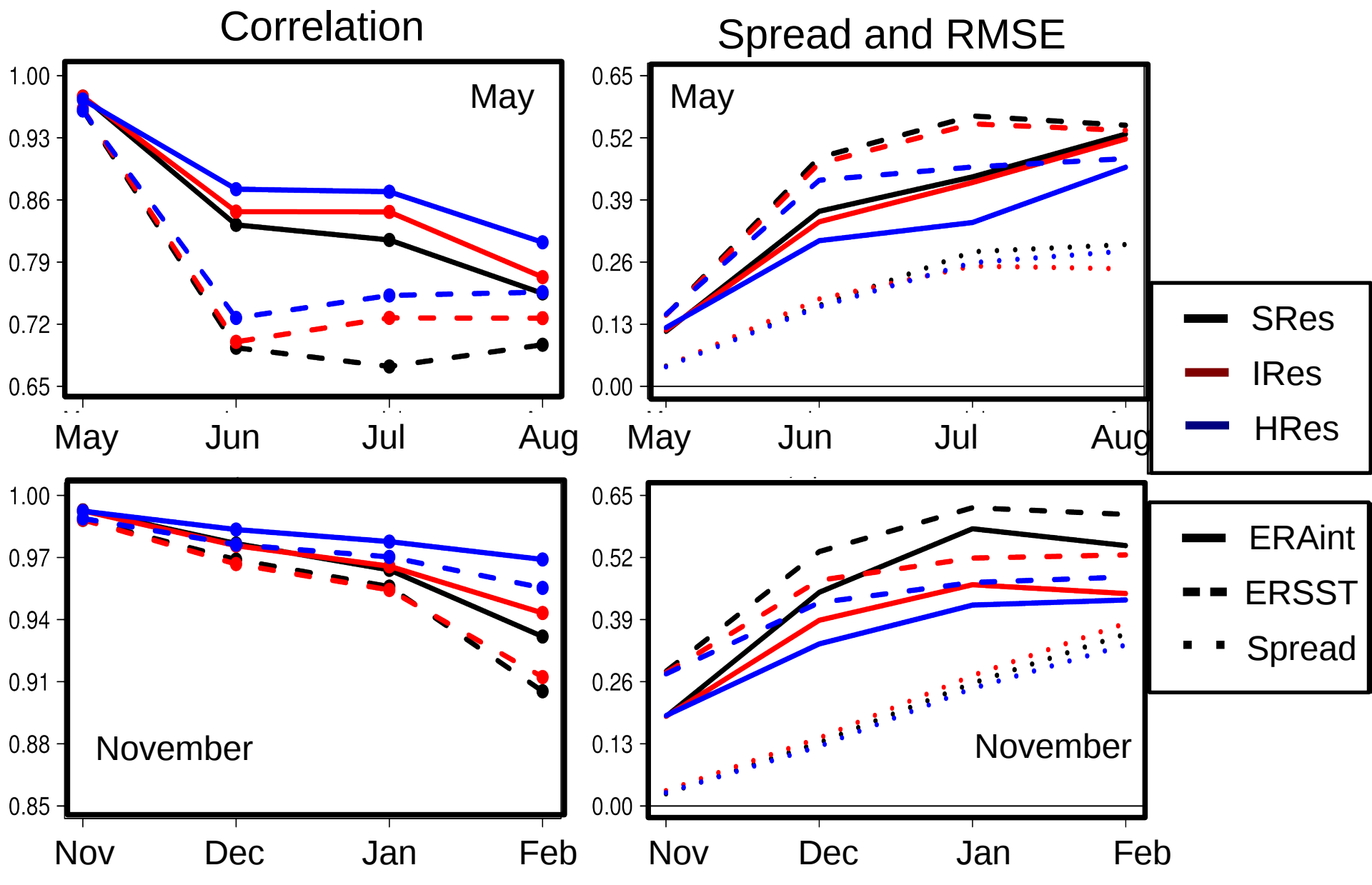


SST JJA (ERSST)

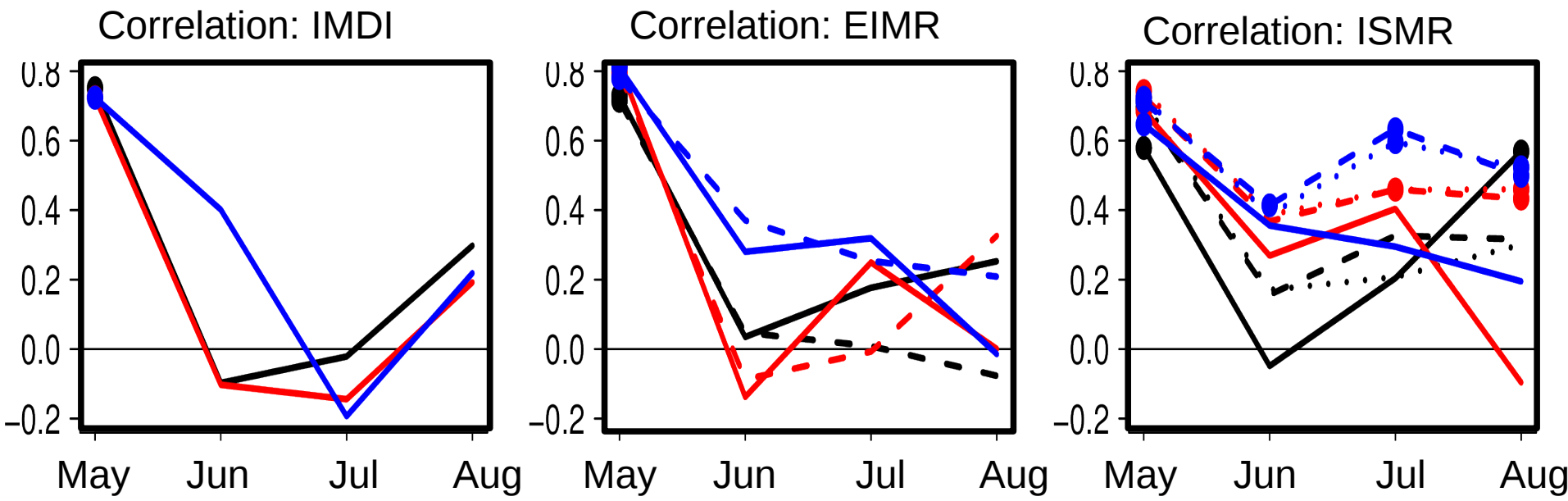


Skill changes are noisy and no improvement is detected at grid point level.
Similar conclusion for winter.

Impact on skill: Niño 3.4



Impact on skill: Indian Monsoon



Onset date Correlation:
SRes: 0.61
IRes: 0.69
HRes: 0.65

SRes
IRes
HRes

ERA-Interim
GPCP
GPCC

Summary and Conclusion

- Increase of both oceanic and atmospheric resolution improves the representation of the mean state.

	SST	Land T2M	Precipitation	Land precip
May	**61.5%**	**57.6%**	**50.5%**	**59.5%**
November	**60.2%**	**60.7%**	**55.3%**	**60.2%**

- Grid-point skill changes are sparse and noisy.

	SST	Land T2M	Precipitation	Land precip
May	**47.8%**	**53.7%**	**50.6%**	**50.3%**
November	**43.2%**	**48.3%**	**51.6%**	**55.4%**

- The skill of ENSO and of the early stages of the Indian monsoon is improved in HRes.

➢ **The increase of resolution do not lead to any spectacular improvements but to an addition of small improvements.**

➢ Additional work needs to be done on tuning of high resolution simulations and testing new initial conditions.

And if you want to know more....

Paper under major revision in **Journal of Climate**, with lot of additional results on NAO, sea ice and blocking...

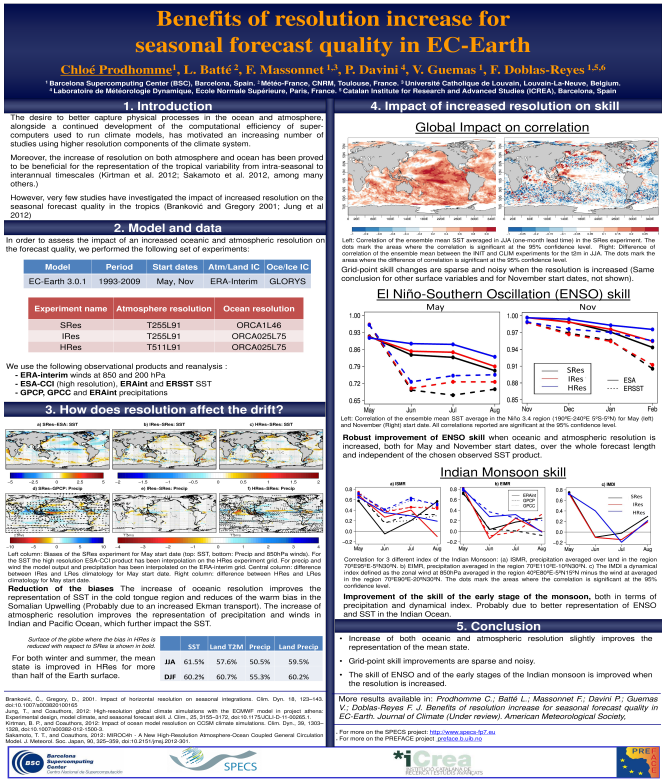
C. Prodhomme, L. Batté, F. Massonnet, F. Massonnet, P. Davini, V. Guemas, F. Doblas-Reyes. Benefits of resolution increase for seasonal forecast quality in EC-Earth. Under review. Journal of Climate

And a poster this afternoon:

17:30–19:00 / Hall X3
X3.206

Thanks for your attention!

Chloe.Prodhomme@bsc.es



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Thank you!

Chloe.prodhomme@bsc.es